Resource allocation

Some problems in applying the national formula to area and district revenue allocations

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SUMMARY The inadequacy of the current national formula in dealing with flows of patients across administrative boundaries is illustrated. In particular, the problems of dealing with varying admission rates for inpatients and in allocating revenue for outpatient services are discussed. We draw attention to an oversight in the recommendations concerning psychiatric services and criticise the general approach to the allocation of revenue under this heading. It is concluded that the national formula should not be applied for revenue allocation at district level in an unmodified form.

The second report of the Resource Allocation Working Party (RAWP) (Department of Health and Social Security, 1976) has attracted much comment and criticism. Critics have been chiefly concerned with questioning the whole validity of a formula approach, or they have discussed factors which the formula ought to have considered. For example, Jones (1976) suggested that the formula does not take enough account of social factors. Other authors have commented on the quality and variability of the data that the allocation will be based on. Geary (1977) has shown how the final allocations may be affected by random fluctuations in a small number of deaths. Recently, Barr and Logan (1977) have criticised standardised mortality ratios (SMRs) as a measure of morbidity and have suggested that until the 'relationship between the input of revenue and the output of patient care' has been more fully investigated, the application of the RAWP's proposals should be postponed.

This paper, however, concentrates on some anomalies in the formula of the RAWP itself and how these may affect revenue allocation within a region. Most of the criticisms are about the treatment of flows of patients and adjustments to

resident populations. The points made are valid at all levels but are relatively unimportant in terms of the effect on final revenue allocations at national or inter-regional level. However, as has been demonstrated by Jones and Masterman (1976), the greatest inequalities of resource provision are found at subregional level and if any progress is to be made towards resource equalisation, the formula used to achieve it must be free from anomalies particularly if these would increase inequalities.

The points made in this paper are considered under the headings of the various populations devised by the resource allocation method. Page numbers of the RAWP's report are given so that readers who wish to check our interpretation of the RAWP's recommendations may do so.

The statistical evidence produced in this paper refers mainly to the South-east Thames Region, reflecting our local involvement in resource allocation. Though the South-east Thames Region may not be typical of the country as a whole, we feel that it is sufficiently representative to show that there are many situations in which the RAWP's formula will not always work well, indeed many where it will work badly.

Non-psychiatric inpatient services

Weighted populations are derived (pp. 97-103) by applying the national hospital inpatient rates by age and sex for each condition to the resident population; they are further adjusted by multiplying by the relevant SMRs or standardised fertility ratios (SFRs).

Movements of patients across administrative boundaries (pp. 103-107) are dealt with by arranging the various flows by specialty into cost groups. These are then weighted (using national costs), summed, and finally divided by the national cost per head of population of non-psychiatric hospital inpatient services in order to convert them to a population equivalent.

The advantages of the method are that it recognises the different demands made on resources by the various specialties. A very serious drawback, however, is that it is based largely on usage. The ratio of national cost per head of population to national cost per case is the national admission rate. The method outlined in the report (while making allowances for differences in the balance of cases) is, essentially, to divide an observed number of net imported or exported cases by the national admission rate, thus converting them to a population equivalent. This differs from the normal method of calculating catchment populations from Hospital Activity Analysis (HAA) data.

The usual method is to take the smallest convenient geographical unit (for example, a parish or local government district) and allocate its population to the health districts that serve this area, according to the proportion of total cases dealt with by the various health districts. This is the same thing as dividing annual numbers of deaths and discharges from such a geographical unit to a health district by the local admission rate. A consequence of the method is that however high or low the admission rate is in any given geographical unit, the total population allocated from that unit to the various health districts must always exactly equal the population of the unit.

This contrasts with the method adopted by the RAWP; the higher the admission rate is for a given area, the greater the population accredited. The populations corresponding to such patient flows (unlike the weighted resident population), are thus based on local rather than national usage.

An example may serve to illustrate the differences between the two approaches. For the sake of simplicity, the effect of the relative costing of specialties has been ignored. We also assume for the moment that there is one catchment area for all specialties. This point will be taken up later.

Consider a parish A, within a health district X. The population of A is 3000 and 100 cases a year are admitted to the hospitals of district X from the parish. However, 500 cases are dealt with by neighbouring district Y. Between them, the two health districts deal with all the cases from parish A.

The admission rate per 1000 persons from A is clearly

$$\frac{(500 + 100)}{3000} \times 1000 = 200 \text{ per 1000}$$

The normal catchment population calculation would proceed as follows:

Population of A served by X =

$$100 \times \frac{1000}{200} = 500 \text{ persons}$$

Population of A served by Y =

$$500 \times \frac{1000}{200} = 2500 \text{ persons}$$

Total = 3000 persons

The RAWP's calculations (ignoring costs of different specialties) would be as follows:

Flow from X to Y = 500 cases

Population corresponding to flow

$$= 500 \times \frac{\text{national cost per case}}{\text{national cost per head}} \\ = \frac{500}{\text{national admission rate}}$$

Let us assume the national admission rate is 100 per 1000 persons. The RAWP's method would then subtract 5000 persons from the weighted population of district X and add this population to district Y. Thus the adjustment population exceeds the total population of parish A by 2000 persons, despite the fact that some cases are dealt with in district X.

If the local admission rate is higher than the national one, the RAWP's method will overestimate flows. Conversely, if it is lower than the national one, it will underestimate flows. Of course, the particular example given is an extreme one and it may be argued that a high admission rate merely reflects a greater need for services (for example, because of an elderly population) and that, therefore, it is reasonable that a flow population can be changed in this way. But the point is that two only partially corresponding systems are being used to allocate resources to the same heading and that the resulting discrepancies can lead to injustice.

However, it is more likely that different admission rates reflect different levels of service

provision as usage of health facilities correlates more with supply than with demand. This way of dealing with cross boundary flows will therefore tend to exacerbate and not reduce inequalities.

The consequence of this discrepancy at national level may not be very serious, since inter-regional flows form a small portion of the regions' total caseload; for a health district, however, interdistrict flows may account for a large proportion of inpatients and the consequences of this in terms of resource allocation may be considerable. To estimate the value of this difference of method for Kent Area Health Authority, we compared the final weighted population for the whole area using the RAWP's method on resident population and on net flows, with a population derived simply by costing all observed cases as in the method reserved for flows. This second method produced a final population that was only 85% of that arrived at by the first method. We calculate that the admission rate for Kent area with respect to its catchment population (based on 1975 SH3 and a 1974 estimate of population supplied by the South-east Thames Regional Health Authority) is 94.8 per 1000. This compares with a national rate (1974) of 107.2 per 1000 calculated from *Health and Personal Social Services Statistics for England 1975* (Department of Health and Social Security, 1975). The admission rate in Kent is thus 88% of the national rate and it would appear that this largely accounts for the difference observed in the two methods of calculation. The example below illustrates that important sums of money may be affected by these discrepancies.

Consider an area W split between two districts, C and D. Both districts have a resident population of 250 000 and the age and sex structure of both populations is identical with the national structure. However, the non-psychiatric inpatient catchment population of C is 350 000, while that of D is 150 000. There are no flows of patients in or out of W. The balance of cases between specialties in both districts is the same as the national caseload structure but the overall admission rate for W, which is constant across the area, is 80% of the national rate. If the element of revenue representing non-psychiatric inpatients were split between C and D according to catchment population, C would receive 70% and D 30% of the area budget. However, the population equivalent of the net flow of cases between D and C is 100 000 persons. The RAWP's method would accredit only 80% of this flow. Thus the final population of C would be estimated as being 330 000 persons and that of D as being 170 000. The revenue would be split

as follows: C to receive 66% and D to receive 34%. The area allocation might be over £30 million a year altogether and since the national expenditure on non-psychiatric inpatients is about 55% of the health service total, the district target allocations would be well over half a million pounds adrift. This disparity might be greater than the resource inequality the RAWP's method would seek to rectify.

Day and outpatient services

The report of the RAWP (Department of Health and Social Security, 1976) recommended (pp. 108-109) that the weighted population for day and outpatient services should be calculated by applying national hospital day and outpatient attendance rates by age and sex to the resident population. A further adjustment was made by applying overall sex specific SMRs. The only allowance made for movements of patients across boundaries was to adjust these populations to reflect agency arrangements. The reason given for not making further adjustment for flows was that there are no statistics generally available to measure such movements (para. 2.18.3, p. 23).

To test the effect of allocating expenditure to outpatient services according to resident population we correlated 1975 outpatient attendances (from SH3) with resident populations. The exercise was performed for the six health districts in Kent and also for the 15 districts and the one single district area health authority within the South-east Thames Regional Health Authority. For the districts in Kent, the correlation coefficient was equal to 0.20, for the South-east Thames Region as a whole the value was 0.06.

If the outpatient catchment areas do correspond with resident populations, only an extremely large variation in attendance rates could account for such a low figure. Correlation with acute inpatient catchment populations, supplied by the South-east Thames Regional Health Authority's Statistics and Operational Research Department and based on a selection of specialties present in most district general hospitals, was much higher. For Kent, the figure was 0.80, for the South-east Thames Region it was 0.72.

Figures 1 and 2 are scatter diagrams comparing outpatient attendances with resident and catchment populations. These figures suggest that resources for day and outpatient services would be better allocated by inpatient catchment areas rather than by resident population.

Fig. 1 Visits by outpatients in relation to resident population.

Fig. 2 Visits by outpatients in relation to catchment population.

Psychiatric patients

The method of adjustment used by the RAWP (Department of Health and Social Security, 1976) (pp. 115-117) is split into two parts.

In the first part, an adjustment is made for short-stay patients by referring net exports or imports to the total national number of psychiatric inpatient cases per head of population. The criticism previously made in connection with non-psychiatric inpatient flows applies here as well and it is, if anything, more serious. It is not uncommon for a district to provide a psychiatric inpatient service for two or more other districts, and flows must form an important part of any allocation to this heading at district level.

For long-stay patients, adjustments are calculated by referring the observed number of cases dealt with by a district to the number of cases one would expect given the size of the resident population and its age and sex structure. The difference in caseload is converted to a population equivalent by multiplying the relevant national cost for either long-stay mental handicap or mental illness patients, summing the resulting costs, and dividing by the national cost per head of population on long-stay psychiatric patients.

In passing, it is worth noting that this method conceals a trap for the unwary. The report rightly stresses the importance (para. C22.2, p. 115) of adjusting the observed and expected cases to the year of allocation from the year of estimation by taking into account the annual national rates of decline in long-stay numbers (9% for mental illnesses and 7% for mental handicap). However, no such point is made regarding the cost per year of patients with a mental handicap or a mental illness and the national expenditure per head of population on long-stay psychiatric patients. Presumably, this is because it is felt that inflation will affect both the cost per year per patient and the cost per head of population and, therefore, the ratio between these will remain the same. However, as the proportion of long-stay cases decreases, so must this ratio and this must be taken into account when performing the calculations.

Furthermore, a major omission in the RAWP's report is the failure to identify the appropriate weighting factor, based on the estimated national proportions of revenue expenditure, to be used in combining the adjustments for movements of psychiatric patients across administrative boundaries, into the aggregate weighted total. The proportions quoted for the adjustments to be made to weighted resident populations (12.2% for mental illness and

5.7% for mental handicap) cannot be used for two reasons.

Firstly, the method appears to be converting flows to full population equivalents although the recommendation (para. C21, p. 115) is ambiguous. Certainly the long-stay adjustments are converted to population equivalents and therefore if the proportion of expenditure on all (say) mental illnesses is used to convert the flow adjustment there will be double counting, since the proportions of national expenditure quoted in the RAWP's report will include expenditure on long-stay cases.

For the long-stay adjustment the situation is even more confusing since the mental handicap and mental illness adjustments are included together. Clearly this requires the use of a weighting factor reflecting the proportion of National Health Service expenditure on all long-stay psychiatric patients. No such factor is mentioned in the report.

The reason we draw attention to these difficulties is that adjustments for the movement of psychiatric patients will be an important element of district allocations, since many districts have no psychiatric inpatient facilities. Obviously there are problems here that must be resolved before the process of subregional resource allocation can proceed.

Discussion

The difficulties to which we have drawn attention arise from differences between the statutory boundaries and catchment areas of health districts. Because the allocation was discussed by the RAWP primarily in terms of the distribution of resources between regions, a method was devised which viewed flows as necessitating minor adjustments to target allocations already derived from the characteristics of the resident population. We are not convinced that this is an adequate philosophy with which to approach the problem of allocation between districts. The RAWP recognised the importance of flows at district level (for example, on p. 37) but concluded, nevertheless, that revenue targets will 'provide an objective yardstick of relative disparity against which the need for resources and, therefore, the crucial allocation process can be determined' (p. 41). What is required, however, is a new approach to the problem in which 'Allocation must reflect the populations served, not simply those who reside within the administrative boundary' (p. 22).

Such an approach would of course have problems of its own. So far in our examination we have assumed that there is a defined catchment population for each health district for all specialties. This is

clearly not the case. There are many factors influencing geographical referral patterns and the location of units is clearly one of them. Since not all specialties will be represented in all hospitals, catchment populations will vary greatly between specialties. One would suppose that there would be a different catchment area for each specialty within the hospitals of a district, although one might expect the differences between those referred to as 'district specialties' (for example, general medicine, geriatrics) to be less than for those referred to as 'regional specialties' (for example, neurosurgery). Thus a resource allocation method based on catchment populations would be very complicated. Catchment populations by age and sex would need to be produced for all the main specialties. These would then have to be weighted by national utilisation factors and finally combined in such a way as to reflect the differing costs of various specialties. It is not difficult to see why the RAWP opted for the simpler approach of using resident populations and costing cross-boundary flows. It may well be impractical to operate a resource allocation method based on catchment populations. Apart from the difficulties in calculating target allocations using such a method, the quality of the data might be even more suspect than that currently used in the RAWP's formula. However, as long as we continue to use a formula that is orientated towards the administrative bodies that deliver health care rather than towards the populations that receive it, the suspicion will remain that apparent disparities in provision reflect not so much an inequitable distribution of resources as discrepancies between administrative and natural boundaries of health care.

We argue that there are two major advantages in using a catchment area formula. The first is that catchment areas reflect patient flows that should equate with local professionals' appreciation of the patterns of patient care. The RAWP's approach to resource allocation is through a complicated formula and any way of relating this somewhat esoteric process to the experience of those working in the field must increase its credibility and thus its acceptability. Furthermore, the catchment area method can be modified as a result of policy discussions or major capital developments. One of the great problems in operating regional resource allocation purely on the RAWP's formula is how to deal with revenue consequences of capital schemes. The RAWP's formula is essentially retrospective and districts will be credited with the effects of changed patient flows only after they have become established.

Perhaps a compromise can be effected if the RAWP's target allocations are regarded as being only one of many possible indicators to be used in assessing the appropriate distribution of resources. In that case before moving resources to reflect these allocations, regional health authorities should carry out independent studies to examine health care inequalities; and these studies should be based on receiving populations and not on distributing authorities. In practice this is likely to involve considerable work in collating HAA and in obtaining results from neighbouring regions. One possible approach would be to calculate admission rates for health districts by examining all admissions to all hospitals from a given district and investigating the corresponding variation of uptake of hospital care across the region to see if some districts really are favoured compared with others.

The alternative to a formula approach is to return to 'incrementalism' or to 'planning by decibel'. It is inherent in the philosophy of the 1974 reorganisation that attempts be made to measure the levels of health care supply and demand and to relate one to the other. To abandon the formula approach would be to take a backward step; however, we feel that the experience of the Department of the Environment with the rate support grant shows that a formula approach can

be made to work and that there is really no viable alternative. The problem is to find a good formula.

The formula approach represents such a large step forward that it would be unwise to prejudice its long-term success by applying it hastily to inappropriate situations.

The opinions expressed here are not necessarily shared by the authors' employing authorities.

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